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LOCK ASSEMBLY FOR A MOBILE PART OF A VEHICLE BODY SUCH AS A HATCH OR A DOOR, ESPECIALLY FOR A REAR HATCH

The invention pertains to a lock assembly of the type indicated in the introductory clause of Claim 1. Here a mobile part is free to move with respect to a stationary part of the vehicle body, this movement normally being of a pivoting type between a closed position and an open position of the mobile part. The closed position of the mobile part is secured by a lock. Such locks are usually operated electrically and/or by remote control. In an emergency, however, such as when the electrical control system fails, the lock can be unlocked mechanically by using a key to actuate a lock cylinder.

These lock assemblies also include a handle on the mobile part, this handle being free to pivot in a plane perpendicular to the vehicle body. Normally, i.e., when at rest, the handle is in its down position, which is flush with the vehicle body. In this position, the handle protects the lock cylinder. So that the mobile part can be opened manually, the handle is swung

out into its open, projecting position. It is thus possible to grip the handle conveniently and to pull the mobile part open. In an emergency situation, the lock cylinder is also accessible to the key when the handle is in its up position.

In the known lock assembly of this type (DE 100 45 224 A1), the lock cylinder is mounted permanently in a housing, which is built into the rear hatch of the vehicle. The opening in the housing is normally closed by a cover, which can be pivoted around an axis parallel to the plane of the cover. In its open position, the cover functions as a handle, which can be used to open the rear hatch. The axis of the stationary lock cylinder is oriented toward the opening in the housing. The output of the stationary lock cylinder is connected permanently to the lock, so that, in an emergency, the lock can be moved by the inserted key between its locking position and its unlocking position. For safety reasons, the lock cylinder must be of considerable length, so that the required number of tumblers can be lined up next to each other in the axial direction. This means that the unit takes up an undesirable amount of space in the area assigned to it in the rear hatch -- space which is very limited to begin with.

In a known lock assembly of a different type (DE 199 29 243), the keyhole of the lock cylinder is located behind the cover of the vehicle emblem provided on the mobile part. The key can be provided with access to the lock cylinder simply by pivoting or pushing aside the cover. The emblem does not serve as a handle for opening the mobile part. The lock cylinder rests in the mobile part behind the movable cover.

A lid lock for a trunk lid is known (DE 802 046), which consists of two directly adjacent lock parts, which extend across the joint between the movable trunk lid and the stationary trunk lining. The lock part seated on the lining has a spring-loaded locking bar, which extends across a bottom plate of the adjacent lock part, which is seated on the trunk lid. The actual handle is pivotably supported on the bottom plate and is spring-loaded in the direction toward its down position. Although a lock cylinder moves along with the handle, the insertion opening for the lock cylinder is on the visible side of the handle. As a result, the lock cylinder is accessible to the key both in the down position and also in the projecting position and is therefore always unprotected.

The lock cylinder can therefore easily become dirty and thus unusable. In addition, the lock cylinder serves only to secure the handle in its down position on the bottom plate. No provision is made for an emergency situation. So that the handle can be pivoted into its projecting position, the lock cylinder must be actuated by the key. During this pivoting movement, a profile edge of the handle of the lock part on the lid pushes the locking bar of the adjacent lock part far enough away that it releases the bottom plate.

In a lock assembly according to the not previously published DE 101 23 939 A1, the cover does not serve as a handle by which the mobile part can be swung open, but rather as a rocker to actuate the electrically motorized opening of the mobile part. A lock cylinder is mounted on the rear surface of the cover. When the cover is in its down position, this cylinder points into the interior of the mobile part. The cover is pivotably supported at its center so that it can pivot around a horizontal axis and is held in its covering position by a spring. The cover can be moved from its covering position into three different pivot positions. When the cover, which functions as a rocker, is pivoted around a small angle of 15°,

it actuates a microswitch, which electronically opens the lock. In this first pivot position, the rear-side lock cylinder cannot be reached by the key. In an emergency, the cover can be pivoted manually around a larger angle of approximately 45° until a spagnolet, located on the output of the lock cylinder makes contact with a stationary lobe on the mobile part. Now, however, the key can be inserted into the lock cylinder, as a result of which the spagnolet is pivoted away from the lobe, and a mandrel on the lock cylinder comes into alignment with an axially movable pin in the interior of the mobile part. Now the cover can be moved manually into a third pivot position, where the mandrel meets the pin and pushes it axially inward. As a result, an unlocking device inside the vehicle is mechanically actuated.

The invention is based on the task of developing a reliable lock assembly of the type indicated in the introductory clause of Claim 1 which is designed to be more compact in the depth direction. This is accomplished according to the invention by the measures cited in Claim 1, to which the following special meaning attaches:

In the invention, the handle and the lock cylinder form a combination, which moves as a unit during the pivoting movement; this combination carries the first element of a rotating coupler. When the combination is in its outwardly-pivoted, projecting position, the lock cylinder, which is on the rear side, is accessible to the key. When the lock cylinder is turned by the key, the first element is turned as well, for which reason it will be referred to in the following as the ``rotating coupler element''. A second, opposing element of this rotating coupler is mounted at a defined point on the mobile part, and when it is turned, its rotational movement is intended to act on the lock. This second, opposing element will be referred to in the following as the ``opposing rotating coupler element''.

Normally, in the down position of the combination, the rotating coupler element located on the combination is disconnected from the opposing rotating coupler element, for which reason, aside from the fact that that the lock cylinder is inaccessible to the key, no torque can be transmitted between the lock cylinder and the opposing element. Because the opposing rotating coupler element is mounted in the same

perpendicular plane in which the rotating coupler element moves during the pivoting movement of the combination, the coupling area of this first element travels into the opposing coupling area of the opposing element during the last phase of the opening movement, for which reason it is now possible for torque to be transmitted by the key-actuated rotation of the lock cylinder. In the projecting position, therefore, the torque being transmitted is able to move the lock from its unlocking position into its locking position and vice versa.

In the invention, therefore, the lock cylinder assumes two different positions in the mobile part of the vehicle body, one being the down or closed position, the other the outwardly-pivoted, projecting position. In the down position, the lock cylinder is advisably parallel to the handle, which means that it extends essentially in the main direction of the vehicle body. The large available height of the handle can be used to accommodate the lock cylinder. Because the lock cylinder extends in the main direction of the handle, it is possible to install a large number of tumblers in the cylinder, which increase the number of possible permutations. The lock cylinder and the key can have a very extensive code, which improves the

anti-theft security of the lock assembly according to the invention. In the depth direction of the mobile part, the inventive lock assembly occupies a surprisingly small amount of space, which corresponds only to the cross section of the lock cylinder. Because the lock cylinder is always oriented in the main direction of the handle, it is accessible to the key even at relatively small pivot angles. In the outwardly-pivoted position, the lock cylinder of the combination extends considerably beyond the vehicle body.

Additional measures and advantages of the invention can be found in the subclaims, in the following description, and in the drawings. The drawings illustrate an exemplary embodiment of the invention:

-- Figure 1 shows a plan view of part of a vehicle body's rear hatch, which functions as the mobile part, the handle being shown in its down or closed position;

-- Figure 2 shows a rear view of the lock assembly of Figure 1 before it has been installed in the rear hatch, which is indicated in dash-dot line;

-- Figure 3 shows a longitudinal cross section through the lock assembly along the line III-III of Figure 1;

-- Figures 4 and 5 show two cross sections through the lock assembly according to Figure 2 along the cross-sectional lines IV-IV and V-V shown in that figure;

-- Figure 6 shows a perspective view, from the rear, of the lock assembly shown in Figure 2, where the initial part of a Bowden cable is shown, which is a component of a link chain leading to the lock (not shown) of the rear hatch;

-- Figure 7 shows a side view of the inventive lock assembly from the perspective of the arrow VII in Figure 2; and

-- Figure 8 shows a longitudinal cross section corresponding to Figure 3 through the lock assembly with the handle in its outwardly-pivoted position, in which the lock cylinder, which moves along with the handle, is accessible to a key.

The drawings show only a part of a rear hatch 10, serving as a mobile part of the car body. A structural unit 11, consisting of a shell-like housing 30 and a handle 21, which normally closes off the opening 31 of the housing, is mounted in the rear hatch 10. Fastening means 39 for the handle can be seen in Figure 2. As is especially clear in Figure 4, the housing 30 is traversed by an axis 15, indicated in dash-dot

line, around which the handle 21 is supported in such a way that it can pivot in the housing in the direction of the arrow 25 of Figure 3. This axis 15 will be referred to below as the ``pivot axis''. The pivoting movement proceeds in the planes of the drawings of Figures 3 and 8. From this it can be seen that the pivoting movement 25 proceeds in a plane which is perpendicular to the main direction of the vehicle body at the location of the structural unit 11, that is, perpendicular to the plane of the rear hatch 10.

It can be seen from Figure 4 that the handle 21 is designed as a two-layer plate; it comprises a base plate 22 and a decorative arched plate 23. The decorative plate 23 carries a company emblem 24. Permanently connected to the handle 21 is a lock cylinder 40, which therefore participates in the pivoting movement 25 of the handle 21. This structural unit 20, consisting of the handle 21 and the lock cylinder 40, is referred to as the ``combination'', as previously mentioned. The lock cylinder 40 in this case is integrated into the material of the handle 21 and is located on the handle's rear side, characterized by the number 26 in Figure 4. A cylinder housing 42 holds the lock cylinder 40 and is designed as a single unit

with the base plate 22 of the handle 21. The cylinder axis 44, indicated in dash-dot line in Figure 3, is essentially parallel to the plane of the base plate 22 and lies in the same perpendicular plane as that in which the pivoting movement 25 of the combination 20 takes place. Figures 1-7 show the closed position of the combination 20, which is emphasized in Figure 3 by the auxiliary line 20.1. In this case, the visible side of the combination 20 is essentially flush with the body of the rear hatch 10. The lock cylinder 20 is protected in the interior of the housing.

The output 43 of the lock cylinder is normally connected nonrotatably to a first element 45 of a rotating coupler by way of a freewheel coupling 46, comprising several elements known in and of themselves; the coupling point at the end of the rotating coupler consists of the interior space 47 of a fork. This rotating coupler element 45 is also a component of the combination 20 and accompanies its pivoting movement 25. It will be referred to as the ``movable rotating coupler element 45''.

In the housing 30, a ``stationary opposing rotating coupler element 35'' is assigned to this movable rotating coupler

element 45; this opposing element has a flat profile piece 37, which serves as its coupling point. When the two parts are coupled together, the flat profile piece 37 fits into the interior space 47 of the fork of the movable rotating coupler element 45. The stationary opposing rotating coupler element 35 is supported rotatably at a defined point in the housing wall 33 by means of a bearing neck 36. On the outside of the housing 31, it is connected nonrotatably by way of an intermediate element 34 and a restoring spring 38 to a driver 16. A link chain 50, which, in the present case consists of a Bowden cable and which leads to the lock in the rear hatch 10, is connected to the driver 16. The core 51 of the Bowden cable, as can be seen at 17 in Figure 6, is hooked onto a terminal claw on the driver 16. The sheath 52 of the Bowden cable 50 is attached at 18 to the housing 30. When the lock is in its locking position, the driver 16 is in the starting position indicated in solid line in Figure 6, emphasized here by the auxiliary line 16.1. The previously mentioned restoring spring 38 determines this starting position 16.1. In dash-dot line, Figure 6 also shows the actuating position, designated by the number 16.2, of the driver 16. When the driver 16 is pivoted into this actuating

position 16.2, the core 51 of the Bowden cable is carried along, and the lock of the rear hatch 10 is released. Thus the rear hatch 10 can now be opened, as will be described in greater detail on the basis of Figure 8.

In the down position 20.1 of the combination 20, the previously described movement of the driver 16 is not possible, because the cylinder axis 44 of the movable rotating coupler element 45 is separated from the axis of rotation of the stationary opposing element 35 by the angle 19 shown in Figure 3. It is also impossible to rotate the lock cylinder 40, because the handle 21 of the combination 20 makes the interior 32 of the housing inaccessible. This situation changes, however, when the combination is pivoted outward into its open position 20.2 shown in Figure 8. Now the cylinder axis 44 is aligned with the axis of the stationary opposing element 35, and the movable rotating coupler element 45 is therefore in rotational engagement with the opposing element 35. That is, the flat profile piece 37 of the opposing element 35 is located in the interior space 47 of the movable rotating coupler element 45. When it is in the outwardly-pivoted position 20.2, furthermore, the keyhole of the lock cylinder 40 is readily

accessible to the key 41. If the correct key 41 is inserted into the lock cylinder 40, the turning of the key leads to the previously described movement of the driver 60, which acts on the lock. Torque is thus transmitted between the lock cylinder and the driver 16, which leads to the lock. By turning the key 41, the lock can be shifted between its locking position and its unlocking position in an emergency situation.

The outward pivot angle designated by the number 19 in Figure 8 is determined by a stop 28 on the combination 20 and by a counterstop 48 on the housing 30. These are designed in a special way according to the invention.

Another component of the combination 20, as Figure 3 shows, is a protective sleeve 27, 29, which is also formed as an integral part of the base plate 22, and which has a special sleeve profile. The sleeve has a narrow section 27, which, in the down position 20.1, accepts the flat profile piece 37 of the stationary opposing rotating coupler element 35. This narrow sleeve section 27 is shown especially clearly in Figure 5. The dimensions of this narrow sleeve section 27 are selected so that the flat profile piece 37 just fits, with slight clearance. As a result, a double guide action is obtained. The flat profile

piece 37 of the opposing element 35 is thus secured in a defined rotational position. In addition, this rotational position of the stationary opposing rotating coupler element 35 is maintained during the pivoting movement 25 until the opposing element's flat profile piece 37 enters the interior space 47 of the fork of the movable rotating coupler element 45. This rotating coupler element 45 is accommodated in an expanded section 29 of the protective sleeve.

The protective sleeve 27, 29 prevents the opposing element 35 from being manipulated during every phase of the pivoting movement 25, but it also functions in this way both in the down position 20.1 of Figure 3 and in the outwardly-pivoted position 20.2 of Figure 8. In Figure 8, the two engaged elements, namely, the element 35 and the opposing element 45, are located in the wide section 29 of the sleeve.

The narrow sleeve section 27 has a flattened area 28 on the side facing in the direction of the pivoting movement; this flattened area forms the previously mentioned stop which cooperates with the counterstop 48 on the housing. As Figure 3 illustrates, this counterstop 48 is formed by a stepped profile 48, 49 in the housing wall 33. The counterstop 48 is at the

same time the ``tread'' of this step. The ``riser'' 49 of the step, however, also has another function in the down position 20.1, namely, to act as a stop for the combination 20. For this purpose, it is preferable to use a buffer 14 of elastomeric material, which is anchored in a bore in the riser 49 and which cooperates with a suitable flattened area 54 of the cylinder housing 42.

As Figure 4 illustrates, the cylinder axis 44 is set back toward the interior of the housing 32 from the pivot axis 15, which is perpendicular to it. The pivot axis 15, furthermore, is produced by two separate axle pins 12, 13, which consist here of cap screws. The two cap screws 12, 13 extend through housing bores 53 from the two opposite sides 61, 62 of the structural unit 11, passing through the bearing bushes 55, 56 mounted in the housing bores. The threaded parts of the two cap screws 12, 13 are anchored in threaded holes 57. There is a certain gap 58 between the ends of the two tightly screwed-in screws 12, 13. This gap 58 can be used to accommodate the lock cylinder 40. When the screws 12, 13 are made from steel rods, it is almost impossible to tear the cylinder out by force.

As can be seen in the side view of Figure 7, a working arm 59, which cooperates with a microswitch 60, is located on the outside surface of the housing 30.

As can be seen in Figure 4, the arm 59 is made as an integral part of one of the bearing bushes 56. By tightening the cap screw 12, the combination 20 and the arm 59 are connected nonrotatably to each other.

As can be derived from Figure 5, pins 63, which are integral parts of the base plate 22, project from both sides of the cylinder housing 42; these pins accept two shank springs 64. The shank springs 64 are supported at one end against the housing and at the other end against the rear surface 26 of the combination 20. The elastic force which they provide ensures that the combination 20 is normally held in its down position 20.1 of Figure 3.

List of Reference Numbers

10	body of the rear hatch, mobile part
11	structural unit consisting of 20 and 30
12	first axle pin, cap screw (Figure 4)
13	second axle pin, cap screw (Figure 4)
14	buffer on 49 (Figure 3)
15	axis, pivot axis (Figure 4)
16	driver
16.1	starting position of 16 (Figure 6)
16.2	actuating position of 16 (Figure 6)
17	hooking point for 51 on 14 (Figure 6)
18	attachment of 52 to 30 (Figure 6)
19	pivot angle
20	combination
20.1	down position of 20
20.2	outwardly-pivoted position of 20
21	handle of 20
22	base plate of 21
23	decorative plate of 20
24	company emblem on 23
25	arrow of the pivoting movement of 20

26 rear surface of 20

27 protective sleeve, narrow sleeve section

28 flattened area of 27, stop (Figure 3)

29 protective sleeve, wide sleeve section

30 housing

31 opening of the housing

32 interior of the housing

33 housing wall

34 intermediate element

35 stationary opposing rotating coupler element

36 bearing neck of 35

37 coupling point of 35, flat profile piece (Figure 3)

38 restoring spring for 45 (Figure 3)

39 means for fastening 30 to 11 (Figure 2)

40 lock cylinder

41 key for 40

42 cylinder housing

43 output of 40

44 cylinder axis

45 movable rotating coupler element on 43

46 freewheel coupling between 40 and 45

47 coupling point of 45, interior space of fork (Figure 3)

48 tread of the step of 30, counterstop

49 riser of the step of 30

50 link chain, Bowden cable

51 core of 50

52 sheath of 50

53 housing bore for 12, 13 (Figure 4)

54 flattened area of 42 (Figure 3)

55 first bearing bush for 13 (Figure 4)

56 second bearing bush for 12 (Figure 4)

57 threaded holes in 22 for 12, 13 (Figure 4)

58 gap between 12 and 13

59 working arm (Figure 4)

60 microswitch (Figure 7)

61 first side of 11 for 12 (Figure 4)

62 second side of 11 for 13 (Figure 4)

63 pin for 64 (Figure 5)

64 shank spring (Figure 5)